Statement by Donald A.B. Lindberg, M.D.
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Before the Subcommittee on Science, Technology and Space of the
Senate Committee on Commerce, Science, and Transportation
On the President=s FY 2001 Budget Request for the
Next Generation Internet and Large Scale Networking
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Mr. Chairman and Members of the Subcommittee:

It is a pleasure to report to you on the role of the National Library of Medicine in helping the health sciences prepare to use the capabilities of the Next Generation Internet for the betterment of the public health. You may recall that from 1991 to 1995 I had a dual appointment as both NLM Director and head of the OSTP Coordination Office for High Performance Computing and Communications. This was a major interagency program that included 14 departments and agencies. At that time the Internet was still Aterra incognita@ to most of the medical community, and I was pleased to be able to help establish a medical component in the HPCC arena.

Much has changed in the past few years, and, Mr. Chairman, as you may recall, you played an important role in that evolution. On April 16, 1996, you conducted the first public search of our database, MEDLINE, on the World Wide Web. Since that time, MEDLINE usage has soared from 7 million searches a year to a current rate of 250 million. Health professionals and scientists, of course, see Web-based MEDLINE searching as a great asset in their research and clinical care. They can now easily find out what their colleagues are publishing by searching an up-to-date database of more than 10 million scientific journal article references and abstracts. What amazed us, however, was to discover that MEDLINE is also being used by the general public. We estimate that about 34 percent of all MEDLINE searches are done by the public**C**for information about their own health and that of family members and friends.

We realize that not everyone has direct access to the Internet and can take advantage of MEDLINE or our new consumer health site, MEDLINE*plus*. To help remedy this, last month the Library made 49 Aoutreach@ (attached) awards to medical libraries around the country. The aim is to help them to work with local public libraries, schools, senior centers, and other community organizations to help bring the benefits of electronic health information to those who otherwise would be forgotten. I believe that all of us, not just those concerned specifically with the Next Generation Internet, should seek ways to ensure that *all* Americans have access to the information they need to keep themselves healthy.

To ensure that the Internet will continue to support the health sciences, the NLM is a strong supporter of the Next Generation Internet effort. To help create a sound theoretical underpinning for medicine and the NGI, we have sponsored a number of research projects in universities and hospitals and also studies by the Institute of Medicine (on Telemedicine) and the Computer Science and Telecommunication Board (on Data Privacy). All conclude that health care and biomedicine place important demands on the capabilities of the future Internet in such areas as quality of service, medical data privacy, and system security.

These elements are important considerations in many of the testbed applications the Library has supported over the last several years. Spread out over three phases, the NLM will support more than $45 million in NGI projects. These include telemedicine-related projects, advanced medical imaging, and patient-controlled personal medical records systems. These projects have given rise to a new nomenclature, for example, tele-immersion, tele-presence, tele-trauma, tele-mammography, tele-psychiatry, internetworking, and nomadic computing. Spanning the generations, from at-risk infants in Boston to home-bound seniors in Missouri, this research seeks to improve quality, lower costs, and increase effectiveness for delivering health care. We hope the projects will lead to new applications based on the ability to gather information at a distance and to transfer massive amounts of data instantaneously and accurately while maintaining medical data privacy. In the last phase of our support, in FY 2001, there will be a set of meetings to record Alessons learned@ from this work and also a scale-up of selected promising projects to regional or national level.

Advanced medical imaging is a special category that requires more bandwidth than is currently available on the Internet. The extremely large size of NLM=s Visible Human image datasets challenges existing storage and network transmission technologies. A full set of the images**C**both electronic and photographic**C**would require the capacity of more than 100 CD-ROMs. Since this is obviously impractical, we are investigating advanced compression and networking techniques to minimize storage capacity and improve transmission speed over the Internet. The need for such techniques is even greater when we consider that we are currently working with other NIH Institutes and the National Science Foundation to create a super-detailed head and neck anatomical atlas. We will also include appropriate image manipulation tools for use via the Internet, based on open software conventions.

Another area of medical science that requires increased communication capabilities is human genome research. As you may know, the NLM=s National Center for Biotechnology Information (NCBI) maintains the enormous GenBank database of molecular sequences. It now contains some 5 million nucleotide sequences with a total of nearly 5 billion base pairs, and the Web site where GenBank is made freely available, receives some 800,000 queries per day from 120,000 scientists and others around the world. In addition to academic institutions, major biotechnology and pharmaceutical firms are among the heaviest users of the NCBI Web site. They not only search GenBank, but use NCBI-created computational tools such as that which allows researchers to use the growing body of known 3-dimensional structures to infer approximate 3D sequence structure from similarity relationships.

In summary, Mr. Chairman, the need for the capabilities of the Next Generation Internet is apparent to us who work in biomedicine. Its increased bandwidth and expected Quality of Service provision will allow the transmission of complex images in real time for diagnostic purposes, which is not currently possible. Using the Internet to coordinate the gathering and dissemination of information required for conducting extensive multi-site clinical trials is yet another example of a medical application beyond the present capability of the network. Other applications require a guaranteed level of service (for example no data loss, or assured privacy protection) that today=s Internet cannot provide. There are many others that I have not mentioned, such as home healthcare, continuing medical education, public understanding of

science, or even reduction of errors in medical practice. Actually, the very best applications have not yet been developed! Each week brings even better and more imaginative biomedical uses of networks. I'm confident the final result will be a major improvement in American health care.